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CRYSTALLISATION CONDITIONS OF VESUVIUS PHONOLITES

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Crystallisation experiments have been performed on Mercato (8010 BP), Avellino (3360 BP), Pompei (AD79) and Pollena (AD472) phonolites in order to constrain the pre-eruptive conditions of Plinian events at Vesuvius. We used dry starting glasses prepared from fusing twice powdered pumice at 1 bar, to which various amounts of H2O and CO2 were added to achieve fluid saturation, loaded to Au capsules. Experiments were performed at 1-3 kbar, 750-900°C, H2Omelt 1-10 wt% and NNO-NNO+1, using an IHPV fitted with a H2-membrane, with Ar-H2 mixtures as pressure media. Run durations were 7-30 days, and were ended by isobaric quenches. Phase relationships were established either isobarically (2 kb, 750-900°C) or isothermally (800°C, 1-3 kb). Phases crystallised are: sanidine, plagioclase, leucite, nepheline, analcime, scapolite, sodalite, biotite, amphibole, garnet, clinopyroxene, magnetite. Under water-rich conditions, clinopyroxene is the liquidus phase in all compositions. In Pompei and Pollena phonolites, however, it reacts out to garnet at temperatures below 800-820°C. Amphibole is not stable at temperatures above 825°C at 2 kb in Avellino, Mercato and Pompei pumices, and it is always absent in Pollena at any P-T so far explored. Experiments realised below 2 kb and 800°C do not crystallise amphibole in any compositions, except in Pompei at low H2Omelt. Similarly, at 3 kb and 800°C, amphibole is absent in the Pompei. Leucite crystallises only in Pompei and Pollena, and is present at and below 2 kb. At 2 kb, garnet crystallisation is restricted to below 825°C in Pompei and below 800°C in both Mercato and Avellino pumices, whereas it is stable up to 900°C in Pollena. The presence of amphibole in Mercato, Avellino and Pompei pumices constrains pre-eruption temperatures of the magmas to be below 825°C. For Pompei, amphibole and leucite occurrences suggest a pressure of magma storage of 2.1ś0.2 kb. At this pressure, the phase assemblage of Pompei white pumice is reproduced at 815ś10°C, H2Omelt of 6-6.5 wt% (XH2Ofluid of 0.8ś0.05), at an fO2 of

NNO+0.5ś0.5, in agreement with melt inclusion constraints (Cioni, CMP, 140, 40-54, 2000). For both Mercato and Avellino, assuming a similar pressure depth than that of the Pompei reservoir then phase equilibria imply pre-eruption temperatures $< 780°C$ for Mercato and $< 750°C$ for Avellino with, in both cases, H20melt higher than 6 wt% (XH2Ofluid$>$ 0.8) which contrast with melt inclusion data for Avellino (3.1ś0.7 wt%, Signorelli et al., JVGR, 93, 237-256,1999). For Pollena, the presence of amphibole in the pumice shows that additional experiments are needed. However, phase equilibria suggest temperatures higher than $800°C$, H2Omelt < 6 wt% (XH2Ofluid$<$0.8) and pressure below 2 kb.